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EXCISION OF KNEE JOINT.

BY

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PREFACE.

THE following papers appeared at different times and in different journals; hence their somewhat disconnected and fragmentary character. But I have ventured to lay them before the profession again in this form, because I believe that the operation which I am recommending is a good one, being the outcome of a not inconsiderable experience.

The operation herein described is, in its main features, what I have performed in every case, but the details have been modified from time to time.

In operating for strumous disease of a joint, every surgeon nowadays aims at removing, as completely as possible, the various tissues affected, and as little else as possible. Now, I have always looked upon the synovial membrane as the tissue which is most frequently and extensively affected, and at the same time the most difficult to remove thoroughly. From this point of view I have endeavoured to develop a method which would make the removal of the synovial membrane as complete as possible.

When I was a student, surgeons, when excising a joint, mostly aimed at sawing off a certain amount of bone. My master, the late Professor Spence, always clipped away as much of the synovial membrane as he could with scissors, and then destroyed what was left of the gelatinous substance with a solution of chloride of zinc. This method, although in advance of the practice of many surgeons of the day, was deficient in two respects. It could not guarantee the removal of the whole of the diseased tissue, and it left an amount of necrotic tissue behind that was sure to cause irritation and suppuration.

I find that even in the present day clipping or dissecting away the synovial membrane piecemeal, or so much of it as can be got

at, is practised and recommended by some surgeons. To such, and to the profession generally, I recommend my method of procedure in excision of the knee joint.

By dissecting the anterior flap of skin off the synovial mass of disease, by dissecting the latter off the front of the bones, and by subsequently scraping the various ligaments when they are on the stretch and before they are cut, I think that I can guarantee that the synovial membrane will be as thoroughly and satisfactorily removed as it can be.

The removal of an elliptical portion of skin from the front of the joint I have always looked upon as a minor point, yet I have never once omitted it from my operation, and have never had reason to regret the procedure. It has two advantages. There being no redundancy of skin left, apposition is more accurate, and primary union more likely to take place; moreover, the ultimate result is neater.

The analysis of the table which I give shows some interesting and valuable facts. The cases in which the tubercle apparently began in, and was mostly confined to the bone, all did well; whilst those in which the disease was extensive, with abscess and implication of the cellular tissue, did worst. This one would expect. For bone tubercle, when seen, can be comparatively easily removed, while tubercular affections of the cellular tissue are most difficult to eradicate. It will also be noted that in those cases in which subsequent amputation was necessary, the tubercle had returned in the cellular tissue.

Seven cases were somewhat peculiar in their histories. One was not tubercular at all (No. 20). In this case there was a history of syphilis, and at the operation a cavity was found in the head of the tibia containing a dark fluid, no pus, and no necrosed bone.

Three cases that manifested distinct tubercular characters before operation, and in which tubercle was found, had histories indicating that they had originated in rheumatic arthritis (Nos. 2, 12, and 23). In the first case there was a history of "pain and swelling of knee, shoulder, and arms." The pain persisted in the internal lateral ligament of the right knee, then the inflammation extended to the tibia, and at the operation tubercular disease, mainly affecting the tibia, was found. In Case 12, who ultimately

died of phthisis, there was a history of old-standing rheumatism in various joints. But the affection of the right knee, which ultimately led to excision of the joint, commenced with an acute synovitis from a wetting and exposure when patient was serving his time in camp as a militiaman. The third case had and still has subacute rheumatism in several joints besides the one operated on. One case (No. 25) was looked upon as suffering from rheumatoid arthritis before I saw her. When she came into the hospital the joint was so disorganized that little could be made out as to the earlier conditions, but when opened into the joint was very evidently tuberculous. I do not wish to question the diagnosis of the medical man who sent the case to me. Far from it. I think, from the general condition of the patient, that it was very likely that the disease in the right knee commenced as rheumatoid arthritis. But I would like to say that my experience is, that that disease is very like, and apt to be confounded with, senile joint tuberculosis. The two cases that I may call traumatic are very interesting. The one (No. 18) had dislocation of the knee (partial) with fracture of the external condyle (verified at the operation). Ankylosis followed the injury. The joint was never free from pain and irritation, and after four years symptoms of tubercular disease manifested themselves. In the other case (No. 22) the tubercle appeared four years after an operation for genu valgum (Chiene's), which resulted in ankylosis. This operation consists in removing a wedge from the upper surface of the projecting internal condyle and shoving the latter up, thus producing a fracture closely resembling the injury in the former case. The operation has been given up by Mr Chiene in favour of Macewan's.

Looking at these cases, it is interesting to note that tubercular disease may establish itself in a joint as a sequel to a totally different disease or an old-standing irritation, just as epithelioma may develop from simple or syphilitic ulcer of the tongue.

A. G. M.

EXCISION OR ARTHRECTOMY OF THE KNEE JOINT.¹

IN this paper the words excision and arthrectomy are used synonymously, because they literally mean the same thing. I would reserve the term erosion for the operation of removing only synovial disease and leaving the articular surfaces of the femur and tibia. What I understand by the terms excision and arthrectomy is that operation, exclusive of amputation, by which all the diseased tissues are removed with the best possible result to the patient in the shape of a useful limb.

Three years ago I published a paper² entitled, "Two Suggestions for Improving the Operation of Excision of the Knee Joint for Strumous Disease," and recorded eighteen cases. I have now operated on thirty cases, and wish to give my further experience of the method of operation which I have devised. The suggestions which I made were the following:—

"More than twenty years ago, when I was house-surgeon to the late Professor James Spence, I learned that to get a satisfactory result in strumous joints it is necessary to remove the whole of the diseased synovial membrane. To carry out this principle, Professor Spence was in the habit, when operating on the elbow, of cutting away as much of the synovial membrane as he could get with scissors. In operating on the knee he adopted a more thorough procedure, which many members of this Society may remember. This was, after reflecting upwards a semilunar flap of skin, to make a circular sweep with his knife round, and at some

¹ Read before the Medico-Chirurgical Society of Edinburgh, 2nd November 1892, and published in the *Edinburgh Medical Journal* for December 1892.

² Read before the Medico-Chirurgical Society of Edinburgh, 15th May 1889, and published in the *Edinburgh Medical Journal* for July 1889.

distance from the patella, and thus remove in one mass that bone and a considerable portion of the thickened and diseased synovial membrane. This procedure strongly recommended itself to me, and I think that I have even improved on it. My method is as follows:—After reflecting a semilunar flap of skin upwards, well above the patella, I cut through the tendon of the extensor of the thigh a little above the patella, and also through the fibres of the vasti, internal and external. In this way the synovial membrane is exposed, and it is then quite easy to push up the muscular substance, and to draw down the thickened synovial membrane, which comes readily off the periosteum, and has then to be cut at its attachment round the articular surface of the femur. In this way four-fifths or thereabouts of the synovial membrane is removed in one mass with the patella imbedded in it. Those portions of the membrane that cover the ligaments are then removed by the use of the Lister sharp spoon. The ligaments should be scraped till they appear clean and white. They are then cut through to permit of complete flexion of the joint, and the operation is completed by the removal of a sufficient amount of bone.

“There is another procedure which I would recommend. In the old days, when a house-surgeon, I was much troubled, in dressing knee-excision cases, with the skin which lay in a loose, redundant, and troublesome manner in folds over the approximated bones. To remove this redundant skin I act as follows:—After making an incision from behind the one condyle to behind the other, across the front of the knee and at the level of the top of the tibia, I make another cut, commencing and terminating at the same points, but over the centre of the patella. These two incisions include an elliptical portion of skin, which is left attached, and the skin is dissected up over the synovial membrane from the upper cut as described above.

“For this minor procedure I claim two advantages—1. Redundant and unnecessary skin is removed, which makes the limb look neater afterwards. 2. The flap of skin is more easily dissected upwards off the synovial membrane, since it is about an inch shorter than the ordinary flap made by Jones, Fergusson, and Watson, whose method of operating I have followed with the above modifications.”

1. As to the removal of an elliptical portion of skin from the

front of the knee, I have never found it cause the slightest difficulty in the approximation of the cut margins of skin, or in the healing of the wound. On the contrary, the skin edges come together more easily and neatly, and, as a rule, heal by the first intention, except at the ends, where drainage is provided.

After the publication of my paper in 1889, a friend kindly drew my attention to a *Treatise on Excision of the Joints* by the late Mr Syme, in which he describes a method of making the incisions similar to that which I advocate. Mr Syme's words (page 133) are—"The best plan, I think, is to make two semilunar incisions across the fore part of the joint, extending from one lateral ligament to the other, meeting at their extremities, and including the patella between them. Very free room will thus be afforded, which may be easily enlarged, if required, by cutting longitudinally at the point of union of the transverse incisions."

It has been a matter of great satisfaction to me to find that I was treading in the footsteps of Mr Syme when I thought of the double elliptical incision. The main difference between my method and Mr Syme's is that my first incision comes lower down, and thus avoids the objection of the skin cicatrix lying immediately over the line of junction of the bones. The incision is practically that introduced by Fergusson and Jones, and which is generally employed in this country, I think, under the name of the long semilunar or U-shaped incision, with the addition of a second, transverse cut, higher up, these being so made as to isolate a small portion of skin. It is therefore practically that of Mr Syme with the lateral incisions which he suggests added. The first cut is from behind the one condyle to a corresponding point on the opposite side, coming well down on to the head of the tibia. The second cut is across the patella.

One of the most important points in arthroectomy is to get good access to the parts to be removed. The above incisions do this thoroughly. The next thing is to secure efficient drainage; and this is also amply provided for if the first incision be begun and ended well behind the condyles.

2. The other point in my operation is by far the more important, providing, as it does, for the thorough removal of all diseased textures.

In tubercular disease of a joint the tissues affected are principally the bones and the synovial membrane. To remove one of these and leave the other would be a grave mistake.

When the operation was first introduced the practice was to remove bone only, as that was looked upon as the chief diseased part. Taking away only a certain amount of femur and tibia was advocated by the best surgeons. Now, however, it is universally recognised that the proper thing to do in every case is to remove all the disease.

We know that tubercular foci are present not only in caseating centres in the ends of the bones, but also in the thickened synovial membrane, and also in very advanced cases in other parts surrounding, especially in the cellular connective tissue.

In the majority of cases of tubercular knee joints that I have met with the synovial membrane has been diseased, and has seemed usually to be the part earliest and most affected. If, therefore, in such cases an operation be performed which does not provide for the removal of the whole of the synovial membrane, there is considerable risk of tubercular tissue being left behind to form a centre for reproduction of disease.

In reading the opinions of other surgeons in regard to the removal of diseased synovial membrane, I find that many recommend the laborious and most unsatisfactory process of dissecting out such portions as can be got at by forceps and knife or scissors.

The method I recommend provides for the removal of the greater part of the synovial membrane of the knee in one piece (which can be readily done on account of its thickened condition), and for the systematic scraping away of every remaining portion in a manner which ought to be both thorough and satisfactory.

The removal of the patella is not an object in my operation, but is a necessary part, for it comes away in the centre of the synovial mass. I do not consider the removal of the patella a disadvantage; because, (1), it is often diseased; and, (2), if the resulting limb be thoroughly ankylosed and rigid the function of the patella is gone, and the straight limb looks neater without it.

This leads me to speak of the removal of bone and the question of ankylosis.

First, as to ankylosis. Is a stiff limb a disadvantage? Of course it is not so convenient as a perfectly normal one. But that it is not very inconvenient is proved to me by the experience of my patients. One whom I have shown to this Society is as active as a cat (Case 4). Several of them walk with hardly any perceptible limp, and can sit down and rise up without any inconvenience. One woman (Case 23) told me she scrubbed the floor of her house regularly, and managed very well. Her leg is quite stiff but slightly bent.

I have had very little experience of a movable joint. In one of my cases (Case 11) the limb did not become rigid. The resulting joint was so inconvenient that the patient requested a second operation to have the limb stiffened. She never could walk without a supporting splint, because the new joint was too accommodating, and bent any way.

I have never aimed at obtaining a movable joint, because I have never considered that it was an advantage. I have always thought that my duty was to provide for a limb that should be a suitable support. When I see, from the success of others, that an excised knee can be both movable and a reliable support, then I may change my mind and my practice.

In regard to the amount of bone that should be removed, I am inclined to act with a free hand usually. I have so frequently found easeating centres after section of bone (that could not have been diagnosed previously) that I do not think it is a safe procedure to saw off as little as possible, still less to leave the articular surfaces entire. Indeed, I have often required to apply the saw again or to gouge out diseased foci. As to wiring or pegging the bones together, I have tried several methods, and I am not prepared to give my unqualified adhesion to any.

I would now discuss the question,—“In what cases is arthroectomy most suitable?”

Dr Heron Watson, in his able work on *Excision of the Knee*, published in 1867, says (page 70) that cases in which the disease is mostly in the synovial membrane are not suitable. This would exclude most of the cases with which I have had to do. But Dr Watson at that time removed only bone. I consider, however, that the operation is well suited for cases of synovial disease as well as

those in which the bones are mostly affected and those in which there is ankylosis in a bad position. I have had good results in all such cases.

I think that the best way to answer this question is to decide the class of cases in which the operation is inappropriate.

1. I would not operate on very young children, because the limb resulting will not be useful enough. The limb operated on does not grow equally with the healthy one, not solely because of the operation, but because of the disease which necessitates the operation. Every one knows how shrunken and atrophic a limb becomes in which there has been strumous disease (even when recovery has taken place). To excise an infant's knee, then, would be to give the child a mere appendage that would be of less utility than a stump. Amputation is better if erosion should be impossible.

2. I would not advise excision in a case in which a large amount of bone (tibia or femur) would have to be removed, especially if the patient were young. I would prefer amputation.

3. I would not expect a good result in cases in which there is much disease of the parts, for I would despair of being able to remove all tubercular foci. In other words, I would expect in such circumstances recurrence of the disease and necessity for amputation. This occurred in four of my cases, but in every instance I excised against my conviction and advice.

4. Of course, one would never think of preferring arthrectomy to amputation in a case in which there was any tubercular disease in the internal organs. For the comparatively long period during which the patient is obliged to lie in bed, and the greater possibility of the wound not doing well, are very strong arguments against the former operation, which in such cases is the more severe and dangerous of the two.

5. I do not like to operate on a person above the prime of life. One of my oldest patients was 42 (Case 12). His knee took a very long time to become firm—much longer than any of the others. A woman aged 43 (Case 25) (she gave that as her age, but I believe she was 10 years older) died from exhaustion and fatty degeneration of internal organs. On the other hand, a man aged 57 made a good recovery—his joint, however, was not supposed to

be tubercular, but syphilitic. Amputation takes less time than arthroectomy.

6. I look upon sepsis as a contra-indication to arthroectomy only inasmuch as it prevents early or immediate union. I can imagine certain cases in which it might turn the balance in favour of amputation.

RECAPITULATION OF METHOD OF PROCEDURE.

1. Incision from behind and above one condyle of femur to corresponding point of opposite side, brought down to near tubercle of tibia with a well-rounded sweep. Second cut straight across about middle of patella.

2. Flap of skin from upper incision (that across patella) reflected up till muscular fibres of vasti seen. These carefully cut through. Tendon of rectus cut very carefully as it lies embedded in the thickened synovial membrane. Then muscles and tendon raised with handle of knife and fingers till upper border of thickened synovial membrane defined. Diseased mass of synovial membrane then dissected downwards off femur, mainly with handle of knife and fingers, till attachment at articular surface of femur is reached and cut through. Lateral attachments cut. Last of all, attachment to tibia and ligamentum patellæ cut through, and thus anterior portion of diseased synovial membrane removed *en masse*, with patella in centre and elliptical portion of skin attached.

3. All remaining visible synovial membrane scraped away in detail, from lateral ligaments and anterior cruciate ligament,—joint being flexed for this purpose. Semilunar cartilages removed, and joint made clean so far. Then lateral and anterior cruciate ligaments cut, and the posterior ligaments scraped and cleaned thoroughly. All ligaments scraped when *in situ* and tense, or cut away.

4. Enough of bone removed from femur and tibia to thoroughly open the cancellated tissue to inspection, and all osseous tubercular foci dealt with.

5. After approximation of bones, tendon of quadriceps may be stitched to remains of ligamentum patellæ, and then skin flap brought down and stitched. Drainage provided from posterior ends of incision.

TABLE AND NOTES OF THIRY CASES OF EXCISION OF THE KNEE JOINT.¹

Case.	Name.	Age.	Leg.	Date of Operation.	Date of Discharge.	Disease.	Result.	When last seen or heard from.
1.	Donald M.	23.	Right.	Jan. 19, 1885.	May 1, 1885.	Synovial tubercle; sinuses septic.	Fairly good: no pain; walks with two sticks.	Letter, Nov. 1892.
2.	Jessie B.	25.	Right.	Mar. 19, 1886.	Nov. 22, 1886.	Rheumatic synovitis followed by bone tubercle.	Very good.	Letter, Nov. 1892.
3.	Jane S.	26.	Right.	June 7, 1886.	Nov. 18, 1886.	Advanced synovial tubercle.	Very good.	Letter, Nov. 1892.
4.	John S.	17.	Right.	June 25, 1886.	Aug. 20, 1886.	Bone and synovial tubercle.	Very good.	Shown to Med.-Chir. Soc., May 1889.
5.	Isabella M.	18.	...	Aug. 12, 1886.	Oct. 29, 1886.	Extensive tuberculous disease.	Amputation Sept. 23, 1886, for return of tubercle in cellular tissue.	....
6.	Kate B.	18.	...	Aug. 16, 1886.	Nov. 17, 1886.	Synovial tubercle.	Good.	Seen 1891.
7.	Isaac B.	23.	...	Aug. 27, 1886.	Nov. 22, 1886.	Synovial tubercle.	Very good.	Seen 1890.
8.	Margory D.	13.	Right.	Mar. 8, 1887.	May 18, 1887.	Synovial tubercle.	Very good.	....
9.	William C.	20.	Right.	Sept. 6, 1887.	Dec. 8, 1887.	Extensive tuberculous disease.	Amputation Nov. 10, 1887, for return of tubercle in bone and cellular tissue.	....
10.	George R.	30.	Right.	Sept. 27, 1887.	Nov. 30, 1887.	Synovial tubercle.	Very good.	Letter, Nov. 1892.
11.	Mary F.	22.	Left.	Oct. 27, 1887.	Mar. 7, 1888.	Synovial tubercle.	Limb too movable.	Letter, Nov. 1892.
12.	John M.	42.	Right.	Feb. 21, 1888.	May 2, 1889.	Extensive tuberculous disease of rheumatic origin.	Very good.	Died of phthisis Dec. 1891.
13.	Jemima C.	11.	Right.	April 20, 1888.	May 17, 1888.	Synovial tubercle.	Good.	Letter, Nov. 1892.
14.	Janet M.	12.	Right.	June 22, 1888.	July 28, 1888.	Synovial tubercle.	Very good.	Seen June 18, 1890.
15.	David S.	7.	Left.	June 26, 1888.	Sept. 1, 1888.	Synovial tubercle (eruption).	Very good.	Seen 1891. Letter, 1892.
16.	Mrs C.	30.	Right.	Dec. 11, 1888.	Feb. 6, 1889.	Synovial tubercle.	Very good.	....
17.	James L.	19.	Right.	Feb. 16, 1889.	June 19, 1889.	Extensive tuberculous disease.	Amputation May 21, 1889, for return in cellular tissue.	....
18.	William B.	19.	Left.	Feb. 26, 1889.	April 4, 1889.	Ankylosis after partial dislocation; tubercle in tibia.	Very good.	Letter, 1892.
19.	George P.	12.	Left.	June 25, 1889.	Dec. 30, 1889.	Extensive tuberculous disease.	Amputation May 29, 1891, for return in bone and cellular tissue.	....
20.	Richard T.	57.	Left.	Aug. 1, 1889.	Sept. 28, 1889.	Syphilis ostitis.	Very good.	Letter, 1892.
21.	James D.	21.	Left.	Aug. 9, 1889.	Sept. 26, 1889.	Ankylosis after long-standing tuberculous disease healed.	Very good; slight motion.	Seen May 1892.
22.	Lizzie T.	22.	Right.	Nov. 12, 1889.	Mar. 5, 1890.	Ankylosis after operation for genu valgum; tubercle discovered at operation.	Fairly good.	Seen Aug. 1892.
23.	Mrs L.	30.	Right.	Dec. 19, 1889.	Feb. 12, 1890.	Bone tubercle secondary to rickets.	Very good.	Seen 1892.
24.	Maggie T.	16.	Right.	May 2, 1890.	July 29, 1890.	Synovial and bone tubercle.	Very good.	Shown to Med.-Chir. Soc., 1892.
25.	Mrs F.	43 (?)	Right.	May 20, 1890.	....	Tubercle, extensive and acute, after rhomboid arthritis.	....	....
26.	Lizzie A.	15.	Left.	Oct. 21, 1890.	Dec. 30, 1890.	Synovial tubercle.	Very good.	Letter, Nov. 1892.
27.	Annie W.	10.	Left.	Oct. 16, 1891.	Jan. 20, 1892.	Synovial and bone tubercle.	Return of tubercle in femur along line of drill; ultimate result good.	Seen Nov. 1892.
28.	Mrs L.	37.	Left.	Oct. 30, 1891.	Jan. 23, 1892.	Extensive tuberculous disease.	Discharged with sims-lau. 1892; imputation advised.	....
29.	Willie M.	8.	Left.	Jan. 29, 1892.	April 23, 1892.	Synovial tubercle.	Very good.	Seen Jan. 1893.
30.	Willie D.	5.	Left.	June 24, 1892.	Aug. 6, 1892.	Synovial and bone tubercle.	Very good.	Seen Nov. 1892.

CASE 1.—Donald M., aged 23. Admitted Oct. 25th, 1884. Operated on Jan. 19th, 1885. Discharged May 1st, 1885. Gelatinous synovial membrane, ill for three or four years, suppuration and sinuses. Treatment: Scott's dressing and Thomas's splint for three months during stay in hospital previously to operation. Result ascertained by letter in November 1892. Leg not very strong. Patient walks with two sticks, and has been free from suppuration and discharge only during the last two years.

CASE 2.—Jessie B., aged 25. Admitted Dec. 7th, 1885. Operated on March 19th, 1886. Discharged Nov. 22nd, 1886. Disease: tubercle of bone of rheumatic origin. She was received from Dr Wyllie's ward, where she was treated for rheumatism of the knee, arms, and shoulder. No history of injury. Pain persistent in the internal lateral ligament of the knee. Previous treatment: M'Intyre splint; soda and carbolic fomentations. She contracted scarlet fever after operation. Two months later the limb was loose. Eight months after operation the limb was firm and useful. Result ascertained by letter in November 1892. The patient still wears a bandage as support. She can "walk any distance," and do her "work without any trouble."

CASE 3.—Jane S., aged 26. Admitted June 4th, 1886. Operated on June 7th, 1886. Discharged Nov. 18th, 1886. Disease: gelatinous synovial membrane with suppuration. Result was ascertained by letter in November 1892. "Quite as strong as the other one."

CASE 4.—John S., aged 17. Admitted June 20th, 1886. Operated on June 25th, 1886. Discharged Aug. 20th, 1886. Disease: bone and synovial tubercle. Previous treatment: blisters and posterior splint, and Thomas's splint for several months. Result very good. Able to run and jump. Was shown to the Edinburgh Medico-Chirurgical Society in May 1889.

CASE 5.—Isabella M., aged 18. Admitted April 7th, 1886. Operated on Aug. 12th, 1886. Discharged Oct. 29th, 1886. Disease extensive in the bone and synovial membrane. Limb was amputated for return in cellular tissue on Sept. 23rd, 1886.

CASE 6.—Kate B., aged 18. Admitted Aug. 2nd, 1886. Operated on Aug. 16th, 1886. Discharged Nov. 17th, 1886. Disease: gelatinous synovial membrane. Result good; knee firm.

CASE 7.—Isaac B., aged 23. Admitted Aug. 24th, 1886. Operated on Aug. 27th, 1886. Discharged Nov. 22nd, 1886. Disease: synovial tubercle. Result very good. Was seen in 1891, and walked well; leg sound and firm, and there was no complaint.

CASE 8.—Marjory D., aged 13. Admitted March 1st, 1887. Operated on March 8th, 1887. Discharged May 18th, 1887. Disease: strumous synovial membrane. Went out with leg in plaster case. Bones sutured with wire. Result very satisfactory. She was seen in 1890.

CASE 9.—William C., aged 20. Admitted Sept. 1st, 1887. Operated on Sept. 6th, 1887. Discharged December 8th, 1887. Disease: gelatinous synovial membrane with peri-articular abscess. General health bad. Amputation performed on Nov. 10th, 1887, for return of disease in bone and soft parts.

CASE 10.—George R., aged 30. Admitted Sept. 15th, 1887. Operated on Sept. 27th, 1887. Discharged Nov. 30th, 1887. Disease: gelatinous synovial membrane; ill five years. Result ascertained by letter in November 1892; he was enjoying good health, the leg quite strong, and he "able to do any sort of work."

CASE 11.—Mary F., aged 22. Admitted June 8th, 1887. Operated on Oct. 27th, 1887. Discharged Jan. 4th, 1888, with plaster case on, because the knee was too movable. Re-admitted on Jan. 10th, 1890, underwent operation a second time on March 7th, 1890, and was discharged May 2nd, 1890 (two drills were employed). Disease: gelatinous synovial membrane. Ill eight years. Previous treatment: Scott's dressing and posterior splint. The second operation for movable joint was undertaken at the patient's urgent request. Result ascertained by letter in November 1892. Leg strong, and she "can walk any distance," and "does not feel in the least pained or fatigued."

CASE 12.—John M., aged 42. Admitted Feb. 18th, 1888. Operated on Feb. 21st, 1888. Discharged Jan. 19th, 1889. Disease tuberculous and extensive, of rheumatic origin. Bones stitched with strong catgut. History of acute synovitis from wet and exposure while in camp serving his time as a militiaman. He died in Glasgow Poorhouse of phthisis in December 1891. The leg was fairly useful to the last. The patient was very intemperate.

CASE 13.—Jemima C., aged 11. Admitted April 16th, 1888.

Operated on April 20th, 1888. Discharged May 17th, 1888. Disease: synovial tubercle. Ill three months. Result satisfactory. Limb firm.

CASE 14.—Janet M., aged 12. Admitted June 18th, 1888. Operated on June 22nd, 1888. Discharged July 28th, 1888. Disease: synovial tubercle. Result ascertained by letter in November 1892. She was in good health, the "leg as strong as ever," and she "quite able for work."

CASE 15.—David S., aged 7. Admitted June 25th, 1888. Operated (erosion, no bone removed) on June 26th, 1888. Discharged Sept. 1st, 1888. Disease: strumous synovial membrane. Result: knee quite firm, slightly flexed, walks easily. This was ascertained in June 1890, when he was re-admitted for slight injury to the same limb.

CASE 16.—Mrs C., aged 30. Admitted Dec. 5th, 1888. Operated on Dec. 11th, 1888. Discharged Feb. 6th, 1889. Ill five months. Disease: synovial tubercle. Previous treatment: blisters and Scott's dressing with splint. Result ascertained by letter in November 1892. Health good; no pain in the leg and no trouble from it. When seen in 1891 the result was considered very satisfactory.

CASE 17.—James L., aged 19. Admitted Feb. 7th, 1889. Operated on Feb. 19th, 1889. Discharged on June 19th, 1889. Disease: advanced tuberculosis. Ill one year. Amputation was performed on May 21st, 1889, for return of disease in the soft parts.

CASE 18.—William B., aged 19. Admitted Feb. 20th, 1889. Operated on Feb. 26th, 1889. Discharged April 4th, 1889. Disease: ankylosis after partial dislocation backwards, and fracture of external condyle, with commencing tuberculous disease. Four years had elapsed after the injury and two years since the pain and swelling commenced. There was a caseated spot in the head of the tibia and gelatinous synovial membrane. Result ascertained by letter in November 1892. Leg quite strong and useful.

CASE 19.—George P., aged 12. Admitted June 19th, 1889. Operated on June 25th, 1889. Discharged Dec. 30th, 1889, with

sinuses. Amputation took place on May 29th, 1891. There was advanced strumous disease as well as recurrence in the bone and cellular tissue.

CASE 20.—Richard T., aged 57. Admitted April 30th, 1889. Re-admitted on July 26th, 1889. Operated on Aug. 1st, 1889. Discharged Sept. 28th, 1889. Disease syphilitic. Syphilis admitted; no rheumatism. History of injury a year before, symptoms of displaced cartilage. Under rest and 20-grain doses of potassium iodide knee improved, and a soft swelling over head of fibula disappeared. Was sent to Convalescent Hospital with limb in case. Returned with knee much worse. At operation joint much disorganized,—contained extravasated blood and gummatous-looking material under articular cartilage of tibia. Cavity in head of tibia containing dark-coloured fluid, but not communicating with joint. Result ascertained by letter in November 1892. The leg was “sound and well; there was no pain;” it was very strong, and “he could walk three miles in an hour.”

CASE 21.—James D., aged 21. Admitted July 31st, 1889. Operated on Aug. 9th, 1889. Discharged Sept. 26th, 1889. Disease: strumous, and of old standing, with ankylosis and flexion. Result: seen in May 1892—excellent, useful limb; patient walks well, with slight motion of joint.

CASE 22.—Lizzie T., aged 22. Admitted Nov. 7th, 1889. Operated on Nov. 12th, 1889. Discharged March 5th, 1890. There was strumous disease after operation for genu valgum (Chiene's) four years previously. Ankylosis. Result: she was seen in August 1892; she walks fairly well, without either crutch or stick, and the limb is quite firm. The other limb was operated on for genu valgum in 1885.

CASE 23.—Mrs L., aged 30. Admitted Dec. 12th, 1889. Operated on Dec. 19th, 1889. Discharged Feb. 12th, 1890. Strumous disease after rheumatism. Ill eight years. Result: when seen in October 1892, the knee was firm and slightly flexed; she walked with only a slight limp, and did housework regularly.

CASE 24.—Maggie T., aged 16. Admitted Dec. 21st, 1889. Operated on May 2nd, 1890. Discharged July 29th, 1890.

Disease strumous. Ill for one year. Drills were used. Previous treatment: Scott's dressing and Thomas's splint. She returned in February 1891, with sinus, which was scraped and healed up in four weeks. The result was very satisfactory, and was shown to the Edinburgh Medico-Chirurgical Society in November 1892.

CASE 25.—Mrs F., aged 43. Admitted May 9th, 1890. Operated on May 20th, 1890. Died May 24th, 1890, from fatty heart and persistent chloroform sickness. Disease: strumous, after chronic rheumatoid arthritis. Disease began with "jerky" pains a year ago. Clear fluid drawn off with aspirator six weeks before admission. On admission, pulse 92, weak; arteries not well filled; respirations 20; urine 1040, quantity of urates. Operation performed at urgent request of patient on account of great suffering. Amputation advised, but not permitted. The necropsy showed fatty degeneration of the muscular substance of the heart. The liver and kidneys were both very fatty. The brain showed sub-arachnoid effusion. The wound was healthy and sweet, apparently nearly healed.

CASE 26.—Lizzie A., aged 15. Admitted Sept. 5th, 1890. Operated on Oct. 21st, 1890. Dismissed Dec. 30th, 1890, with plaster case on. Disease: synovial tubercle. Drills employed. The result (by letter) was communicated by her father in November 1892. "Walks five miles to her work daily; can run, jump, and skip about as if nothing had been wrong."

CASE 27.—Annie W., aged 10. Admitted Sept. 25th, 1891. Operated on Oct. 16th, 1891. Discharged Jan. 20th, 1892. Drills employed. She was re-admitted on March 10th, 1892, with a sinus along the track of the drill. The leg was healed in May. Result: when seen in November 1892, leg firm and soundly healed. The child walks well, with only a slight limp.

CASE 28.—Mrs L., aged 37. Admitted Oct. 26th, 1891. Operated on the 30th. Discharged Jan. 23rd, 1892. Drills employed. Result: sinuses; limb no use; amputation advised.

CASE 29.—Willie M., aged 8. Admitted Jan. 25th, 1892. Operated on the 29th. Discharged April 23rd. Drills employed. Disease: synovial tubercle. Result: when seen Jan. 11th, 1893, leg firm and useful, child able to run about, go to school, etc. Hardly any limp with a high heel.

CASE 30.—Willie D., aged 5. Admitted May 28th, 1892. Operated on June 24th. Discharged August 5th, with the limb in plaster. Disease: synovial and bone tubercle, with abscess in the head of tibia. One drill was inserted. Previous treatment: Scott's dressing and Thomas's splint. The wound healed with only two dressings. Result: when seen in November 1892, limb quite firm and useful. Patient walks and runs about with very slight limp.

ANALYSIS OF THE TABLE.

1. There were two deaths. One (No. 12) took place three years and ten months after the operation, and was therefore not properly attributable to it. The other (No. 25) occurred from fatty heart and chloroform sickness four days after the operation.

2. Four cases of amputation for return of disease (Nos. 5, 9, 17, and 19). N.B.—No. 28 should be added, for disease still exists, and amputation ought to be performed. In all these cases excision was performed under protest (as it were), amputation having been advised from the first. Amputation was recommended also in Cases 12 and 25, both of whom died.

3. The oldest patient was aged fifty-seven, the youngest five years. The average age was about twenty-two years.

4. The right leg was the one operated on in fifteen cases, the left in eleven. In the remaining four cases the side is not mentioned.

5. The disease on account of which excision was performed was tuberculous in all but one, which was syphilitic (No. 20). In three cases (Nos. 2, 12, and 23) the tubercle was secondary to rheumatism, and in one (No. 25) to rheumatoid arthritis. Injury (dislocation, No. 18), and an operation (No. 22, for genu valgum), were the apparent exciting causes in two cases after an interval of four years in each. In thirteen cases the tubercle was apparently confined to the synovial membrane. In three cases bone tubercle alone existed, whilst in twelve all the tissues were affected.

6. I can speak decidedly of the result in twenty-eight of the cases which were seen or heard from at periods varying from one to seven years after operation. Two have died; four have undergone the operation of amputation, and one more ought to be amputated. In three cases the resulting limbs have been fairly useful, and in the remaining eighteen cases the results have been

very satisfactory to the patient as well as to the surgeon. This, however, includes one case of erosion. Of the thirteen synovial cases ten had a very good result; the three bone tubercle cases were all very good; whilst of the twelve more advanced cases only three gave very good results, two were "good," four were amputated, one ought to have been amputated, and two died. Of the two cases that have not been heard from or seen lately, one was operated on a year ago with good results, and the other is believed to have had fairly good results.

I present these cases to the profession as an illustration of what may be done to conserve useful limbs by means of an operation which fifty years ago was not looked upon with much favour. I claim that the results are as good as are likely to be obtained by any similar operation. My method of operation is described by me at length in a paper which appeared in the *Edinburgh Medical Journal* for July 1889, and again in the number for December 1892. The main features of this method I set before me when I began to operate in 1885. The exact steps of the operation which my experience of these thirty cases has led me to adopt I have given, as already stated. Since making up the foregoing table I have operated twice, and both of the patients have left the hospital with firm and apparently useful limbs. Without giving details unnecessarily, I may say that I aim at removing the anterior (and principal) portion of the diseased synovial membrane by reflecting the skin off it, and dissecting it out as if it were a tumour (and a tuberculous tumour it certainly is). I scrape away (this being the longest part of the operation) the remaining synovial membrane before cutting the fibrous structures which they cover. I prefer to remove slices of bone from the femur and tibia, because I have frequently found unsuspected tuberculous foci after opening up the cancellous texture of the epiphyses. A less important part of my procedure (æsthetic mainly) is the removal of a portion of skin from the anterior flap so as to do away with the redundancy of skin, so perceptible in the earlier operations which I remember having seen. Perhaps I may be permitted, in conclusion, to remark that it is not my usual practice to excise strumous knees. I successfully treat them generally (even in hospital patients) by rest, counter-irritation, and immobilization.

POSTSCRIPT.

In the *Clinical Journal* of 8th February 1893, Mr Barker, of University College Hospital, in a clinical lecture on Excision of the Knee Joint, gives an account of 25 consecutive cases in which he had operated by his method of scraping and flushing. I cannot pretend to his success in rapid healing, but I would like to say that I do not quite agree with him, judging from my own experience, in the following points:—

1. The long incision, commenced well behind the condyles, does not tend to cause sloughing of the tip of the flap; but then I cut the flap off. On the other hand, this horseshoe-shaped incision gives ready access to the joint, and affords good drainage.

2. Removal of a slice of bone from the tibia and femur does not interfere much with the usefulness of the limb. My patients have done very well with their slightly shortened limbs. While, on the other hand, I think a firmer and closer union is likely to be got by the union of the two flat sawn surfaces, and solidity is of more importance than length. I have so frequently found unsuspected foci of tubercle in the cancellated ends of the bones that I would not be happy without taking off a slice from both bones, unless I could be very sure that the disease had commenced in the synovial membrane, and was limited to it.

This leads me to say that I agree with Mr Barker that the disease frequently attacks the synovial membrane first, and spreads from it to the bone. One often sees most beautiful examples of this process on opening up diseased joints. But I believe that tubercle may also not unfrequently commence in the bone, and from that origin spread to the other tissues.

Mr Barker himself mentions facts that seem to me rather to favour the use of the saw, although I admit that his results with the flushing-spoon are very remarkable. These facts are:—

(a.) We always find more advanced disease than the outward signs would lead us to expect, did experience not teach us that the disease is always in excess of the symptoms in tuberculosis. Can we, therefore, always be sure that there is not some unsuspected tubercular area in the tibia or femur that might be exposed by removing a slice of bone?

(b.) Again, Mr Barker mentions the scraping out of cavities in

the ends of the bones. These will necessarily take some time to fill in with solid material, even though the external wound should heal by the first intention, and therefore *solid* union of the tibia and femur will not occur so soon as if the cavity had been obliterated, or made more shallow, at any rate, by the removal of a slice of bone.

(c.) Once more, Mr Barker says that the first bond of union is fibrous, and that flexion may occur before osseous or firm fibrous union takes place. On this account he makes his patients, especially the young ones, wear a plaster splint, or some other apparatus, for years after the operation, to prevent flexion occurring. In my cases I have removed all apparatus whenever I found the limb firm, which was in from two to three months, and have never seen any tendency to flexion.

There are many things in which from experience I agree with Mr Barker. Cases seen early enough should be cured by immobilization ; and this is best secured by a plaster-of-Paris case extending from the foot up to the natal fold,—otherwise the knee joint is not thoroughly commanded.

Arthrectomy should not be performed till such treatment has failed to arrest the *progress* of the disease. Under such circumstances a stiff joint is the best result that can be expected. Among hospital patients, whose surroundings are not favourable, an operation saves time, securing at once a rigid and useful limb, and often saving the necessity for resorting to amputation.

Movable knee joints are only to be got in circumstances under which recovery might be obtained by immobilizing the limb.

I agree with Mr Barker that pegging and suturing are unnecessary. But I think they may even be dangerous, by conducting tuberculous matter into the ends of the bones.

I notice that Mr Barker does not use a tourniquet. My friend Mr Mitchell Banks tells me that he does not use one either in his operations on the knee joint any more than on the hip. I have always used the Lister tourniquet. Perhaps the disuse of it would prevent after-oozing, and would enable one, like Mr Barker, to do without drains. Certainly no vessels of any consequence are cut. Those cut ought to be easily and quickly secured with Wells' forceps, and thus a dry wound may be more readily secured before stitches are tied.

I am glad to see that Mr Barker draws attention to the atrophy

and arrest of growth present in diseased limbs before operation. I am quite sure he is right in saying that excision, by providing a firm limb that can be used, is more likely to check than increase this condition.

[This atrophy and want of growth is variously accounted for by writers. I have not seen attention directed to what I have always noticed when I have had to amputate for tubercular disease, viz., that the arteries are remarkably small. Is this due to contraction from vaso-motor irritation ?]

Esmarch of Kiel has recently introduced a method of treating tubercular affections by congestion, which I have been trying in my wards with some measure of success. Does this in any way atone for the deficient blood supply ?]

The method of incision and removing the anterior portion of the synovial membrane with the patella, described by Mr Barker in his lecture, is almost exactly the same as mine ; but I carry my first incision a little lower, and make a second rather higher, thus enclosing and removing a portion of skin. I lay great stress on scraping the remaining portions of synovial membrane from the tendons before they are cut ; Mr Barker lays stress on the use of the flushing process. This I have used in abscesses and in some joint cases, but not in excision of the knee.

I get almost as early and complete closure of the skin wound as Mr Barker does ; but as I have always used a drain of protective tissue at each end of my wound, these corners have always remained open for some time after the rest of the wound had healed (by first intention). But I have generally had some oozing for a few hours after the operation, and therefore have always looked upon drainage as necessary.